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The background of the central section is a futuristic digital interface. It features a glowing Earth globe in the center, surrounded by various data visualizations including bar charts, line graphs, and network diagrams. The interface has a blue and white color scheme with a grid-like background. The text 'INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH' is overlaid in large, bold, white letters with a black outline.

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# Development of Process for Biscuits of Wheat flour and Pearl Millet flour supplemented with Fenugreek Seeds Powder

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**ABSTRACT:** This experimental paper aims to develop the process for biscuits of wheat flour and pearl millet flour supplemented with fenugreek seeds powder. The study focuses on the physical analysis, nutritional analysis, color, sensory and textural analysis of the prepared biscuits. The physical properties included measurements of diameter, thickness, and spread ratio, while the nutritional properties encompassed moisture content, fat content, ash content, protein content, and fibre content. Color analysis was done on the basis of  $L^*$ ,  $a^*$  and  $b^*$  values. Sensory evaluation was conducted to assess attributes such as taste, texture, appearance, and overall acceptability. Textural analysis was assessed on the basis of cutting and bending tests. The results demonstrated that the addition of fenugreek seeds powder positively influenced the nutritional composition of the biscuits. The sensory evaluation indicated that the biscuits formulated with optimal levels of fenugreek seeds powder were well-liked by the panelists. This research contributes to the development of value-added products by utilizing fenugreek seeds powder in biscuit formulations. The developed process can be further optimized for large-scale production, potentially promoting the consumption of nutritious biscuits enriched with fenugreek seeds powder.

**KEYWORDS:** Pearl millet, Fenugreek seeds, Biscuit, Nutritional quality, Sensory characteristics, Physical properties

## I. INTRODUCTION

Fenugreek seeds are used as condiment in most parts of India, as a supplement to wheat and maize flour; they are one of the constituents of normal daily diet. Fenugreek seeds also function as a preservative and are added to pickles, chutneys and other similar products. In modern food practice, the seeds or the extract are used in bakery products, frozen dairy products, meat products, relish, condiments, candy, gravy sauces and in alcoholic and non-alcoholic beverages (Uhl, 2000). Wheat (*Triticum aestivum*) is a widely grown cereal grain farmed due to its excellent nutritional value and practical benefits. Along with rice and maize, it is one of the top three crops produced worldwide. Only wheat has significant amounts of the unique proteins gliadin and glutenin, which when combined with water yield gluten, an elastic substance crucial to yeast or aerated-baked foods. In western India (Gujarat, Rajasthan, and Haryana, pearl millet (bajra) is a significant coarse cereal crop. Due to its resistance to challenging growth circumstances including drought, low soil fertility, and high temperatures, it has the potential to be used by humans in the future. Due to its high level of fat and large mineral content, such as iron, calcium, and zinc, pearl millet (bajra) is nutritionally equivalent to and even superior than main cereals (Fasasi, 2009). The combination of these ingredients aims to create biscuits that not only satisfy the taste preferences of consumers but also offer additional health benefits. This research endeavors to explore the feasibility of formulating a biscuit recipe that effectively incorporates the nutritional advantages of pearl millet and fenugreek seeds, while maintaining the desired sensory attributes and overall quality of the final product.

## II. WORK DONE

The primary objectives of this study are:

**Physical analysis:** Physical analysis of biscuits involves the evaluation and characterization of various physical properties and attributes of the baked product. These analyses provide valuable information regarding the diameter, thickness, spread ratio, volume and density of biscuits. The physical properties of biscuits play a crucial role in consumer acceptance and preference.

**Nutritional analysis:** Nutritional analysis of biscuits involves determining the composition and content of various nutrients present in the product. This analysis provides important information about the moisture content, protein, fibre, ash, fat, carbohydrate, iron and calcium of biscuits, which is crucial for understanding their contribution to the overall diet and assessing their potential health benefits or concerns.

**Textural analysis:** Textural analysis of biscuits can be conducted using bending and cutting tests to evaluate their mechanical properties, such as hardness, brittleness, and crumbliness. These tests provide insights into the texture and structural characteristics of biscuits. Textural analysis by bending and cutting tests provides objective measurements that can be used to assess the quality, consistency, and consumer acceptance of biscuits.

### III. METHODOLOGY

The present study was conducted in College of Technology and Engineering, MPUAT (Udaipur). Two different lots of fenugreek seeds were germinated (48 hrs at 37°C) and debittered in solutions like curd (1:1 in water) for 12 h. On the basis of taste seeds lot soaked in a solution will be finalised for further process. The germinated and debittered seeds were then dried inside a tray dryer at 60°C and 100m/min drying air velocity to remove moisture content (Shirke *et al.*, 2020). To get the seeds powder, grinder was used to break down dried fenugreek seeds. In order to obtain a fine final product, the ground material is next permitted to pass through a sieving process with 38 mesh sizes.

By fortifying fenugreek seed powder with pearl millet flour, traditional biscuits nutritional content may be greatly increased. Wheat flour, pearl millet flour and fenugreek seed powder were used to make biscuits. Pearl millet flour was prepared by milling seeds inside a flour mill and fenugreek seed powder were prepared by grinding dried fenugreek seeds in a mixer. The traditional creamy method was used to prepare fenugreek seed powder supplemented wheat-pearl millet flour biscuits (Meena & Meena, 2004). Biscuits were prepared using compositions 50 % wheat flour + 50 % pearl millet i.e., T, 45 % wheat flour + 45 % pearl millet + 10 % germinated fenugreek seed powder i.e. GFSP1, 46 % wheat flour + 46 % pearl millet + 8 % germinated fenugreek seed powder i.e. GFSP2, 47 % wheat flour + 47 % pearl millet + 6 % germinated fenugreek seed powder i.e. GFSP3, 45 % wheat flour + 45 % pearl millet + 10 % debittered fenugreek powder i.e. DFSP1, 46 % wheat flour + 46 % pearl millet + 8 % debittered fenugreek seed powder i.e. DFSP2, 47 % wheat flour + 47 % pearl millet + 6 % debittered fenugreek seed powder i.e. DFSP3. The different compositions of wheat flour, pearl millet flour and fenugreek seeds powder were taken to prepare varied samples of biscuits. The grounded sugar was added to the butter before stirring into cream with the help of spiral separator for around 10 minutes. The prepared cream was then added to the mix of flour and by adding 50 ml of milk, dough was made with hand. A traditional wooden roller "belan" was used to flatten the prepared dough to a thickness of about 6 mm. Then, with the use of a steel mould, circular pieces of 45 mm in diameter were cut off from the flattened dough. These moulds were then kept in a tray and placed inside oven. Biscuit baking was done at a temperature of 180°C for 16 min. Polyethylene bags were used to pack the baked biscuits for further evaluation of the textural properties.

**Physical properties-** Diameter, thickness and spread ratio are measured with the help of a ruler while density is measured as ratio of weight and volume.

**Nutritional composition-**

Moisture content is measured by the hot air oven method (AOAC, 2005)

Protein is calculated according to the Micro Kjeldahl technique (AOAC, 2005)

Fibre and Fat are estimated using Soxhlet apparatus

Ash content is found out with the help of muffle furnace

Carbohydrate = 100 – (fat% + fibre% + ash% + protein% + moisture%)

Water activity was measured with the help of a digital water activity meter

For estimation of minerals like Iron and Calcium flame photometer is used.

**Color analysis-** It is done with the help of Hunter lab calorimeter (Pomeranz and Meloan, 1971)

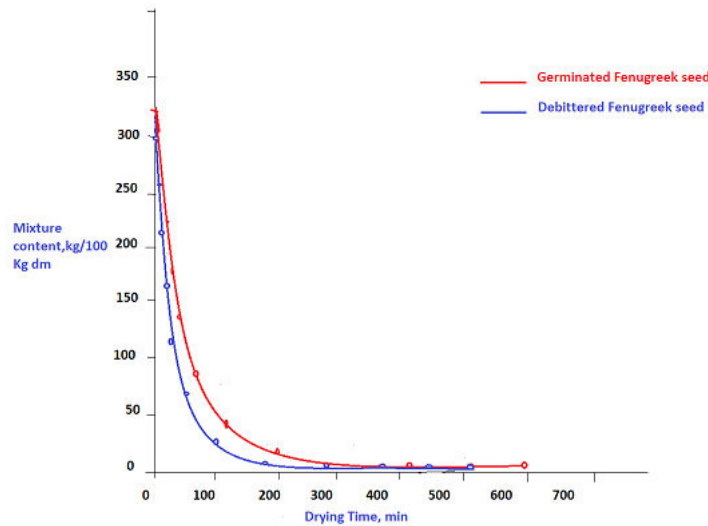
**Sensory analysis** was done on the nine-point hedonic scale and scores were given by a panel of 20 judges (Khedkar, 2004).

**Texture analysis-** Cutting and bending test are the two main tests done to analyse the texture of the prepared biscuits using a texture analyzer.



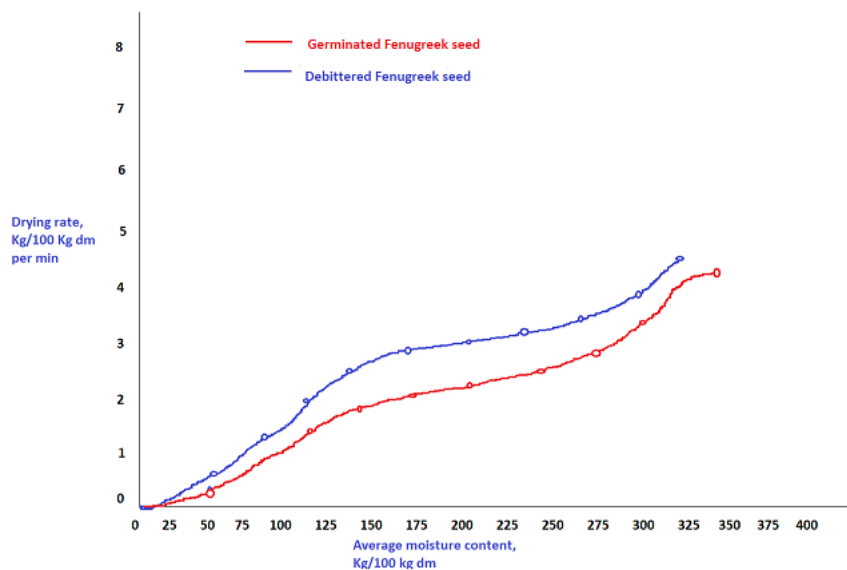
IV. EXPERIMENTAL RESULTS

The initial moisture content of the germinated and debittered fenugreek seeds is about 82.94 percent and 85.27 per cent (wet basis) respectively. Drying time for germinated and debittered fenugreek seeds is 590 min and 510 min respectively at 60°C.



1. Variation of moisture content with drying time

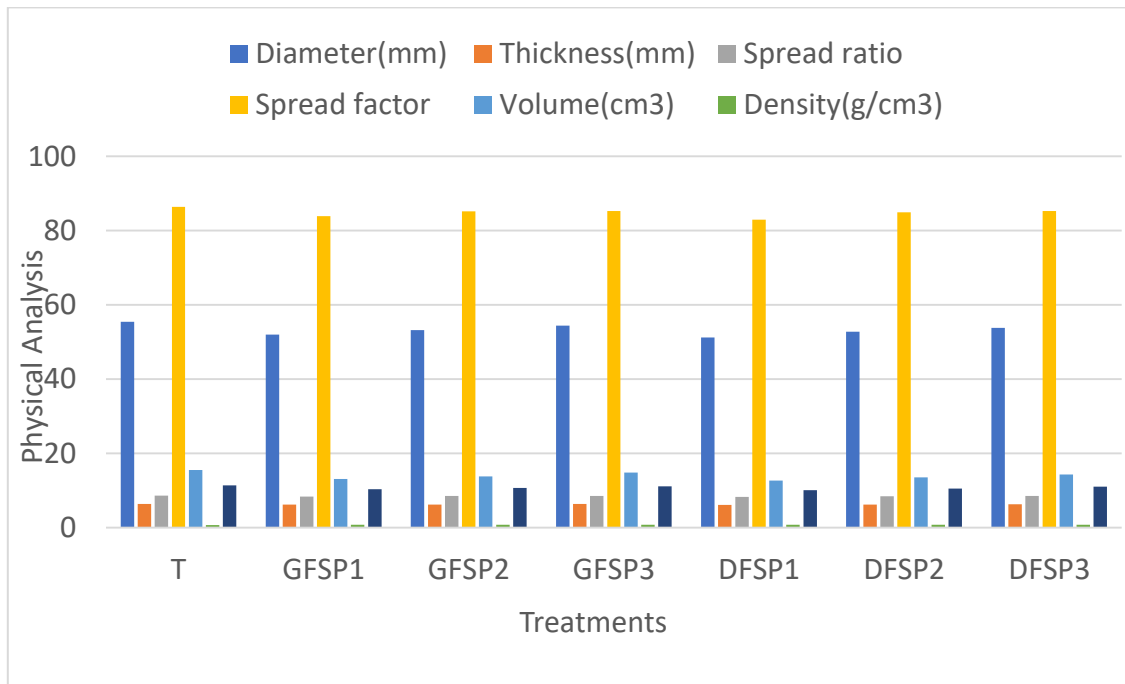
The drying rate graphs appeared to have the same shape. At the initial stage of drying process, the drying rates were found to be maximum as 4.32 and 4.17 g-water/g-dm-h for debittered and germinated seeds respectively. It is observed from the study that drying rates tend to fall gradually as the moisture content of the fenugreek seeds starts decreasing. Drying rates was higher in debittered fenugreek seeds as compared to germinated fenugreek seeds.



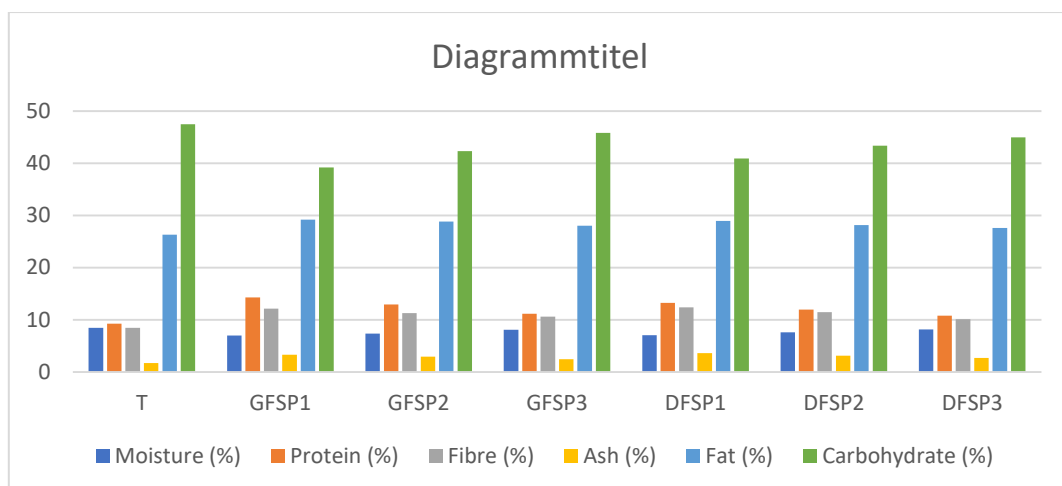


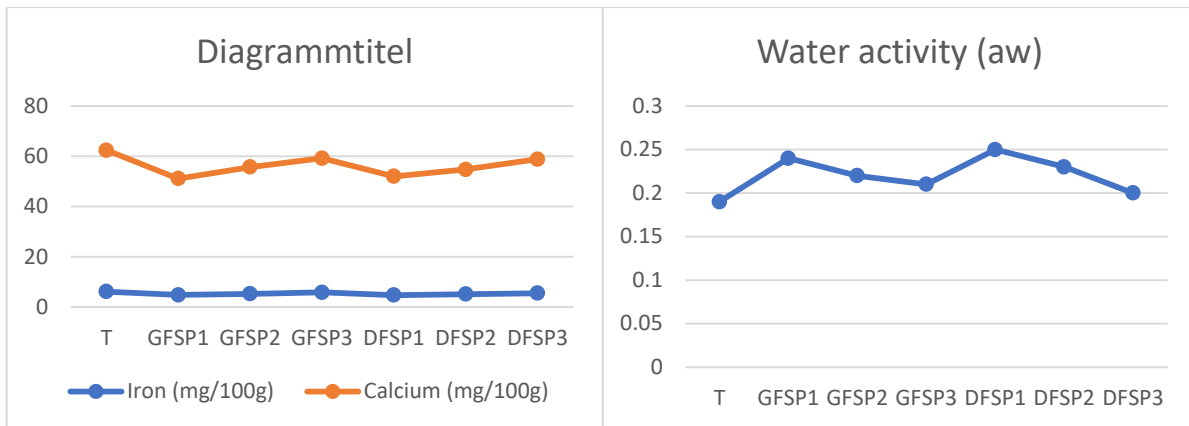
2. Variation in drying rate with moisture content

**Physical properties-** Following study shows with an increase in fenugreek seed content in the formulation, it was discovered that the diameter, thickness, spread ratio and volume decreased while density of biscuits increased.

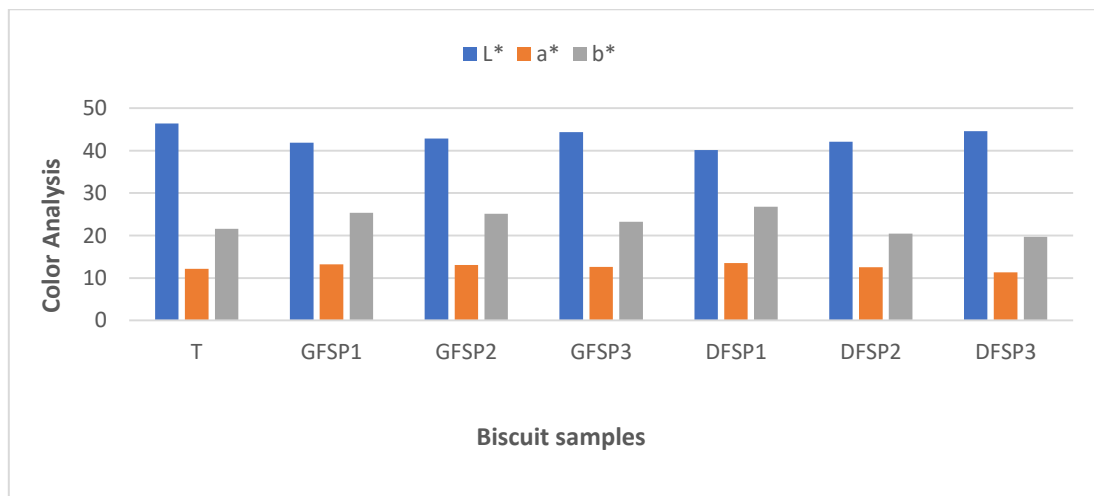


**Nutritional content-** On comparing different compositions of all samples it was found that there was a slight increase in protein, fibre, ash, fat and water activity while on the other hand there was a decrease in the values of moisture, carbohydrate, iron and calcium as the per cent of fenugreek seed powder is increased in wheat and pearl millet flours.

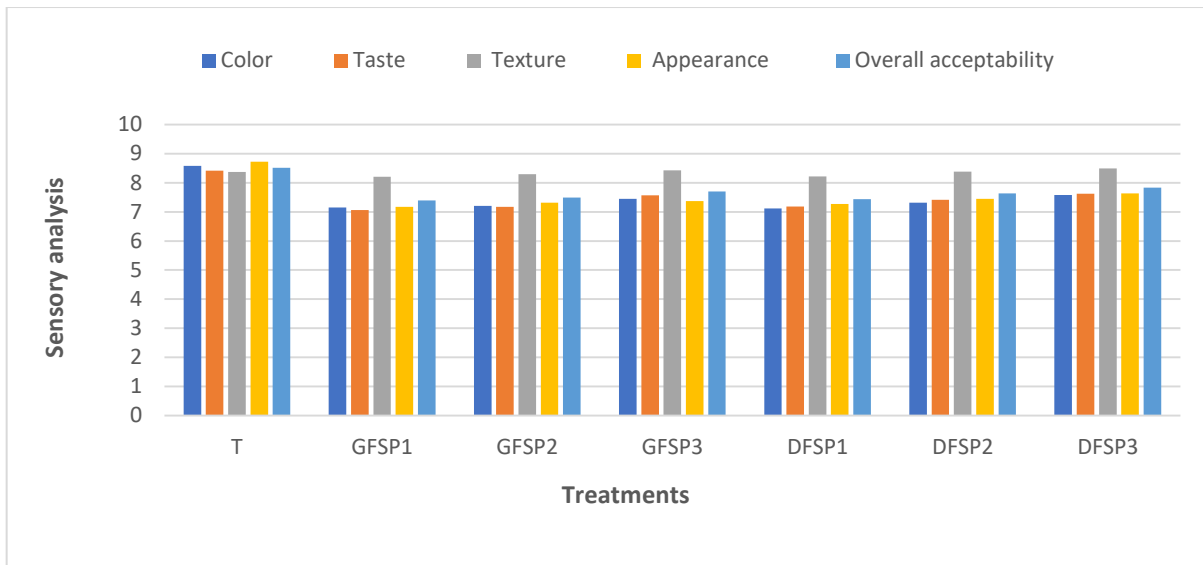




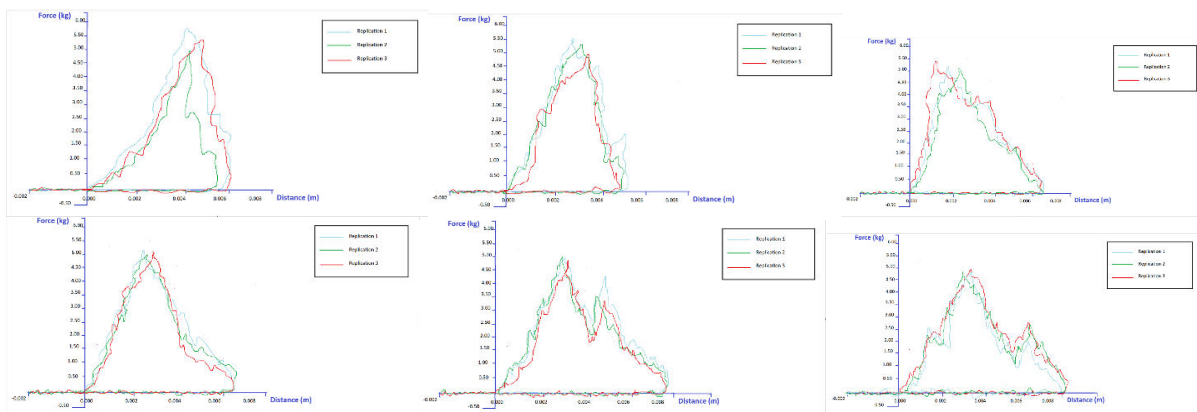
**Color analysis-** One of the most crucial aspects of the quality of baked products is colour. Results obtained out of the color evaluation are shown. The lightness levels of the biscuit samples varied slightly as depicted by L\* values of 38.72-44.57. Low range of a\* values (11.96-13.51), show that the samples baked with a pretty consistent tint of red color. The samples were more yellowish type in color as shown by comparatively high b\* values (19.69-26.79). The brightness of the color of the fenugreek seed-supplemented wheat-pearl millet-based cookies decreased as the amount of fenugreek seed powder was increased. Fenugreek seed powder containing biscuits were comparatively darker (L), redder (a) and more yellow (b) to those of control biscuits.



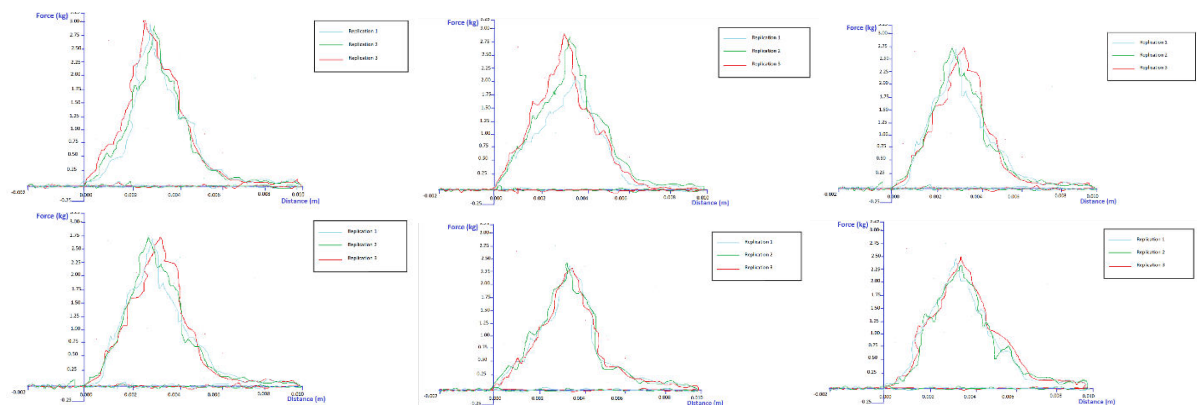
**Sensory analysis-** It was observed that maximum scores for color, taste, texture, appearance and overall acceptability were obtained for the control biscuits, sample T and the second best sample was the 6% debittered fenugreek seed powder mixed biscuit i.e., DFSP3.



**Firmness by cutting test-** It shows that when the blend percentage of fenugreek seed powder increased the hardness of the biscuits continued to decrease.



**Firmness by bending test-** It can be observed that biscuit samples having high percentage of fenugreek seed powder possess lesser hardness.



**V.CONCLUSION**

At last we conclude that the proportions taken for preparing supplemented biscuits have necessary nutrients with good quality, taste and crispy as stated by panellists and also economically very feasible to all categories of people available



with good quality and also acquiring necessary nutrients. On analysing every aspect of the research work i.e., physical, nutritional, sensory and textural properties the best results were shown by the sample DFSP3.

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